Understanding Cognitive Strengths and Needs: Analyzing Data from the WISC-V
Anne-Marie Kimbell, Ph.D.
Pearson Clinical Assessment

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National Training Consultant
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WISC-V

Traditional Format
Paper/Pencil

Digital Format on
Q-interactive

Scoring Options

• Score Report
• Combination
• Narrative

Similar score report output as those available on Q-global, plus:
• Automatic subtest scoring
• Immediate scaled scores

DEVELOPMENT OF THE WISC-V
Revision Goals
1. Update Theoretical Foundations

- Increase breadth of construct coverage by investigating and developing:
  - Visual-spatial subtest
  - Fluid reasoning subtest
  - Visual working memory subtest
  - Subtests to measure additional processes related to learning (working memory, associative memory)
- Coinciding with development of general intellectual ability is the enormous growth in verbal skills during early elementary years.
- Implications for reading and writing development
- Working memory is important to the measure of cognitive functioning
  - Related to fluid reasoning (Burgess & Brawner, 2010; Hornung, 2011; Martinez et al., 2011)
  - Implicated in a wide variety of academic problems and clinical conditions affecting children and adolescents (e.g., Archibald & Gathercole, 2006a, 2007; Arcilla, Cane, & Pelletier, 2010; Hutchinson, Bavin, Efron, & Schieren, 2012; Fitzpatrick & Paggi, 2012)

2. Increase User Friendliness

- Reduce testing time
  - 5 primary index scores: 65 minutes mean (10 minutes shorter than WISC-IV mean)
  - FSIQ: 48 minutes mean (27 minutes shorter than WISC-IV mean)
  - Shorter discontinue rules, fewer items, selecting subtests with briefer admin time to contribute to these scores
3. Increase Developmental Appropriateness

- Instructions
  - Reduce vocabulary level
    - Excluding items on Similarities
  - "Advantages" and other high vocabulary level of items on Comprehension
  - Reduce verbosity
    - Demonstrate, practice, and teach the task
- Replace outdated art and items with more current and relevant

4. Improve Psychometric Properties

- Items and scoring rules
- Norms and norming method
- Maintain or improve reliability
- Floors and ceilings
- Reevaluate item bias
  - Iterative psychometric analyses
  - Qualitative reviews by experts
- Significance level options for critical values

5. Enhance Clinical Utility

- Provide subtests to measure cognitive processes known to be clinically sensitive to learning disabilities
- To enhance pattern of strengths and weaknesses (PSW) approach to learning disability evaluation
  - Naming Speed, Literacy and Naming Speed Quantity
- Immediate, Delayed, and Recognition Symbol Translation
- Provide PSW link in joint software with WIAT-III and with KTEA-3 (and CELF-5 forthcoming)
- Add special group studies based on use
  - Borderline Intellectual Functioning
  - English Language Learners
Enhance Clinical Utility (cont’d)

Composite Score Changes
• Full Scale IQ
  – Does not include all primary subtests
  – Quicker to obtain

• Five, factor-based Primary Index Scores
  – Verbal Comprehension Index,
  – Visual Spatial Index,
  – Fluid Reasoning Index,
  – Working Memory Index,
  – Processing Speed Index

Enhance Clinical Utility (cont’d)

• Test structure
  – Provide factor structure that simplifies interpretation
    (PRI → VSI/FRI)

• Score differences comparison methodology
  – Both index- and subtest-level: Strengths and weaknesses
    then pairwise

Enhance Clinical Utility (cont’d)

• Ancillary Index Scores
  – Quantitative Reasoning Index (QRI)
  – Auditory Working Memory Index (AWMI)
  – Nonverbal Index (NVI)
  – General Ability Index (GAI)
  – Cognitive Proficiency Index (CPI)

• New methods for strength and weakness analysis
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Conceptual Structure

WISC-V Test Framework

Test Structure: Full Scale IQ
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Test Structure: Primary Index Scales

Primary Index Scales
- Verbal Comprehension
- Visual Spatial
- Fluid Reasoning
- Working Memory
- Processing Speed

VCI  VSI  FRI  WMI  PSI

Perceptual Reasoning Index (PRI) Replaced

Test Structure: Ancillary Index Scales

Ancillary Index Scales
- Perceptual Reasoning
- Auditory Working Memory
- Nonverbal
- General Ability
- Cognitive Proficiency

QRI  AWMI  NVI  GAI  CPI

Test Structure: Complementary Scales and Subtests

Complementary Index Scales
- Naming Speed
- Symbol Transliterations
- Storage and Retrieval

NSI  STI  SRI

On Record Form Analysis Pages and in Administration and Scoring Manual Supplement: Optional carry-along
Substitution and Proration
No More “Core” and “Supplemental”

<table>
<thead>
<tr>
<th>FSIQ Subtest</th>
<th>Allowable Substitutions for Deriving the FSIQ*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Similarities</td>
<td>Information or Comprehension</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>Information or Comprehension</td>
</tr>
<tr>
<td>Block Design</td>
<td>Visual Puzzles</td>
</tr>
<tr>
<td>Matrix Reasoning</td>
<td>Picture Concepts</td>
</tr>
<tr>
<td>Figure Weights</td>
<td>Picture Concepts or Arithmatic</td>
</tr>
<tr>
<td>Digit Span</td>
<td>Picture Span or Letter–Number Sequencing</td>
</tr>
<tr>
<td>Coding</td>
<td>Symbol Search or Cancellation</td>
</tr>
</tbody>
</table>

* Only one sub or pro on FSIQ
* No subs or pros on any index score
* Less necessary with the expanded composite score options

Subtest Types and Categories

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Score Type</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block Design</td>
<td>Scaled</td>
<td>Primary (FSIQ)</td>
</tr>
<tr>
<td>Similarities</td>
<td>Scaled</td>
<td>Primary (FSIQ)</td>
</tr>
<tr>
<td>Matrix Reasoning</td>
<td>Scaled</td>
<td>Primary (FSIQ)</td>
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</tr>
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</tr>
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<td>Symbol Search</td>
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<tbody>
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<tr>
<td>Picture Concepts</td>
<td>Scaled</td>
<td>Secondary</td>
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<td>Letter–Number</td>
<td>Scaled</td>
<td>Secondary</td>
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<td>Sequencing</td>
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<td>Secondary</td>
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<td>Cancellation</td>
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<tr>
<td>Arithmetic</td>
<td>Scaled</td>
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<th>Type</th>
<th>Category</th>
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</thead>
<tbody>
<tr>
<td>Naming Speed Literacy</td>
<td>Standard</td>
<td>Complementary</td>
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<tr>
<td>Naming Speed Quantity</td>
<td>Standard</td>
<td>Complementary</td>
</tr>
<tr>
<td>Immediate Symbol Translation</td>
<td>Standard</td>
<td>Complementary</td>
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<tr>
<td>Delayed Symbol Translation</td>
<td>Standard</td>
<td>Complementary</td>
</tr>
<tr>
<td>Recognition Symbol Translation</td>
<td>Standard</td>
<td>Complementary</td>
</tr>
</tbody>
</table>

Changes

Subtests on WISC-IV Dropped from WISC-V

- Word Reasoning
  - Redundant measure of verbal comprehension (high correlation with Information)
- Picture Completion
  - Construct not as representative of visual spatial ability as others (secondary verbal loading)
- And we needed space for new subtests…
WISC-V Subtest Modifications

Changes: New Subtests

WISC-V on Q-interactive
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Q-Interactive
Digital system for individually-administered tests consisting of two primary components.

Central:
Secure, browser-based function for generating client profiles, building test batteries, creating assessment sessions, and sharing results.

Assess:
Application that lets an examiner administer a test via two tablets connected by Bluetooth.

Q-Interactive Central Dashboard

Q-Interactive Components of Assess

No Internet needed after testing

Practitioner
Client

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Organized Notes
- Record Observations
- Color code according to category

Review of Indices & Subtests

Verbal Comprehension
What is represented by the VCI?

- Ability to access and apply their acquired word knowledge
- The application of knowledge involves:
  - verbal concept formation
  - reasoning
  - expression

Changes to Retained Verbal Comprehension Subtests

- Similarities
- Vocabulary
- Information
- Comprehension

- Revised scoring rules with data-based queries
- Reviewed vocabulary level (no more “advantages”)
- New, contemporary item content
- Updated art with increased international portability

*“Why do people use passwords?”*

**“*all items and item images are fake to protect the innocent*”**
What is represented by the VSI?

- Ability to evaluate visual details and understand visual spatial relationships to construct geometric designs from a model.
- Constructional ability requires:
  - visual spatial reasoning
  - integration and synthesis of part-whole relationships
  - attentiveness to visual detail
  - visual-motor integration

Changes to Retained “Perceptual Reasoning” Subtests

Block Design
- New complex designs
- Evaluating new process scores
  - Partial Score
  - Simplified Break in Configuration Error Score

Block Design

**BLOCKS STILL USED!!**
Rotations on Block Design

Visual Puzzles

- Child views a completed puzzle and selects three response options that would combine to reconstruct the puzzle.
- Item time limit of 30 seconds.
- Measures ability to analyze and synthesize abstract information.

Fluid Reasoning
What is represented by the FRI?

Ability to:
1. detect important elements among visual objects
2. to understand their underlying conceptual relationship
3. then apply that knowledge in order to identify another object that best represents the concept

Changes to Retained “Perceptual Reasoning” Subtests

Matrix Reasoning
Two item types retained and taught
- 2x2 matrix
- serial order

Figure Weights

- Child views scale with missing weight(s) and selects the response option that balances the scale.
- Item time limit of 20 or 30 seconds.
- Measures quantitative and analogical fluid reasoning.
Changes to Retained
“Perceptual Reasoning” Subtests
Picture Concepts
   - Items revised so images not reused
   - New items

Changes to Retained WISC-IV
Working Memory Subtests
Arithmetic (Now on FRI)
   - New and revised items.
   - One repetition on difficult items; no repetition on easy items.
   - Increased WM demands.
   - Cross loading (FR and WM).

Working Memory
What is represented by the WMI?

- Measure of verbal and visual working memory and the ability to resist proactive interference.
- Working memory involves attention, concentration, mental control, and reasoning.
- Ability to:
  - register
  - maintain (e.g., temporary storage capacity)
  - manipulate visual and auditory information in conscious awareness

Changes to Retained WISC-IV Working Memory Subtests

Digit Span
- Added trials to Forward ceiling.
- Added some trials for gradient.
- Added new Sequencing task.

Digit Span Sequencing
- Examiner reads a sequence of numbers; examinee recalls the numbers in ascending order.
- *Digit Span Sequencing* is similar to other tasks that are designed to measure working memory and mental manipulation.
Changes to Retained Working Memory Subtests

Letter-Number Sequencing
- Eliminated rhyming letters and numbers.
- Teaching modified for floor:
  - First, teach numbers before letters.
  - Then teach reordering task.

Processing Speed

What is represented by the PSI?

- Speed and accuracy of visual identification
- Decision-making
- Decision implementation

- Performance on PSI is related to:
  - Visual discrimination
  - Visual scanning
  - Short-term visual memory
  - Visuo-motor coordination
  - Concentration
Changes to Retained Processing Speed Subtests

Coding
  - Item difficulty consistent across rows
  - Changed symbols for digital

Changes to Retained Processing Speed Subtests

Symbol Search
  - New symbols
  - Evaluating error scores

Changes to Retained Processing Speed Subtests

Cancellation
  - New art
  - Designed by quadrant (target to distracter ratio)
Complementary Subtests

Naming Speed Subtests
- Naming Speed Literacy
- Naming Speed Quantity

Symbol Translation Subtests
- Immediate Symbol Translation
- Delayed Symbol Translation
- Recognition Symbol Translation

Naming Speed
(Literacy and Quantity)
- Child names elements as quickly as possible.
- Child takes two or three tasks, depending on age.
- Each task has a sample item and a 2-page test item.
- Current rapid naming tasks are relatively less sensitive to math disability if comorbid reading disability excluded (Korkman, Kirk, & Kemp, 2007; Pauly, Linkersdörfer, Lindberg, Woerner, Hasselhorn, Lonnemann, 2011; Willburger, Fussenegger, Moll, Wood, & Landerl, 2008).
- Quantity naming added to improve sensitivity to math disability (Pauly et al., 2011; Willburger et al., 2008).
Symbol Translation

Learn Symbol Word Associations and then translate symbol strings into phrases or sentences.

Immediate Recall
Delayed Recall
Recognition

Symbol Translation

Recognition Sample
Child views a symbol and selects the associated word from among response options.

Scores and Interpretation
Basic Steps to Interpretation

1. Report and Describe FSIQ
2. Report and Describe Primary Index Scores (VCI, VSI, FRI, WMI, PSI)
3. Evaluate Index-Level and Subtest Level Ss and Ws
4. Conduct Ancillary Analysis

Descriptive Classifications

<table>
<thead>
<tr>
<th>Composite Score Range</th>
<th>Traditional Descriptive Classification</th>
<th>WISC-V Descriptive Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>130 and above</td>
<td>Very Superior</td>
<td>Extremely High</td>
</tr>
<tr>
<td>120–129</td>
<td>Superior</td>
<td>Very High</td>
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<tr>
<td>110–119</td>
<td>High Average</td>
<td>High Average</td>
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<tr>
<td>90–109</td>
<td>Average</td>
<td>Average</td>
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<tr>
<td>80–89</td>
<td>Low Average</td>
<td>Low Average</td>
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<tr>
<td>70–79</td>
<td>Borderline</td>
<td>Very Low</td>
</tr>
<tr>
<td>69 and below</td>
<td>Extremely Low</td>
<td>Extremely Low</td>
</tr>
</tbody>
</table>

Primary Index Scores

<table>
<thead>
<tr>
<th>Primary Index Scales</th>
<th>VCI</th>
<th>VSI</th>
<th>FRI</th>
<th>WMI</th>
<th>PSI</th>
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</thead>
<tbody>
<tr>
<td>Verbal Comprehension</td>
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<tr>
<td>Similarities</td>
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<tr>
<td>Vocabulary</td>
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<td>Spatial</td>
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<td>Design</td>
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<td>Fluid</td>
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<td>Reorganization</td>
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<td>Matrix Reasoning</td>
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<td>Figure/Weight</td>
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<tr>
<td>Working Memory</td>
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<tr>
<td>Digit Span</td>
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<tr>
<td>Picture Span</td>
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<tr>
<td>Processing Speed</td>
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<td>Coding</td>
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Technical Properties
- Normative Sample
- Reliability
- Validity
- Clinical Studies

WISC-V Normative Sample
- 11 age groups
- n = 200 per group
- Total n = 2,200
- Nationally Stratified Sample
- Age; Sex
- Race/Ethnicity; PEL
- Geographic Region

Subtest Reliability - good to excellent

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Internal Consistency Reliability</th>
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</thead>
<tbody>
<tr>
<td>Similarities</td>
<td>.87</td>
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<tr>
<td>Vocabulary</td>
<td>.87</td>
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<tr>
<td>Information</td>
<td>.86</td>
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<td>Comprehension</td>
<td>.83</td>
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<td>Block Design</td>
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<td>Visual Puzzles</td>
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<td>Figure Weights</td>
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<tr>
<td>Finger Tapping</td>
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<tr>
<td>Symbol Search</td>
<td>.81</td>
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<tr>
<td>Naming Speed **</td>
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<tr>
<td>Immediate Symbol Tapping</td>
<td>.81</td>
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<tr>
<td>Delayed Symbol Tapping</td>
<td>.81</td>
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<tr>
<td>Recognition Symbol Tapping</td>
<td>.82</td>
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Evidence of Internal Consistency
Primary and Ancillary Composite Scores

<table>
<thead>
<tr>
<th>Composite</th>
<th>Average Reliability Coefficient</th>
</tr>
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<tbody>
<tr>
<td>VCI</td>
<td>.92</td>
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<tr>
<td>VSI</td>
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<td>FRI</td>
<td>.93</td>
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<td>WMI</td>
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<td>PSI</td>
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<td>NVI</td>
<td>.95</td>
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<td>GAI</td>
<td>.96</td>
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<tr>
<td>CPI</td>
<td>.93</td>
</tr>
</tbody>
</table>

Evidence of Validity
Confirmatory Factor Analysis

CFI = .99
RMSEA = .05

Thanks for coming!
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Contact your Pearson Assessment Representative
Nancy McGovern
Nancy.McGovern@Pearson.com

Anne-Marie Kimbell, Ph.D.
Anne-Marie.Kimbell@Pearson.com

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